10.7.1.3 INSPECTION, TESTING, AND MAINTENANCE

Inspection, testing, and maintenance requirements for fire detection and suppression systems are outlined in the NFPA standards. A program should exist that follows either the NFPA standards or a carefully thought-out alternative program that provides an equivalent degree of reliability.

All systems in the facility and its confinement ventilation system, both passive and active, must have inspection, testing, and maintenance plans that have been established and implemented.

Limited Life Materials that will wear out in a relatively short time in all systems should be identified and replaced according to an established plan.

10.7.1.4 IMPAIRMENT PLANNING

A program must exist to handle situations where fire detection and suppression systems are impaired. Pre-plans must be developed and instituted to guide facility operations when these systems are not functioning as they should. Impairment plans also must exist for other critical facility systems. The occurrence of an impairment is not the time to develop such plans. All impairment plans must be analyzed to identify and control to the greatest possible extent the hazards that may exist under a given condition.

Impairment plans should be exercised on a regular basis to maintain proficiency in their execution.

10.7.1.5 MODIFICATIONS

Modifications in a nuclear facility must follow the protocols for Unreviewed Safety Question determination. This is a somewhat roundabout means of identifying the impact to the established safety basis and all that goes with that, but it is what the current culture understands and accepts. Configuration control must be maintained when modifications are made so that all changes are tracked across all affected documentation and all impacts are identified and understood.

10.7.1.6 EMERGENCY PLANNING

The successful mitigation of a fire in a nuclear facility containing a confinement ventilation system requires emergency planning and exercises involving all entities that may be called on to mitigate a fire situation. Post-fire recovery plans should exist to aid in the resumption of work in the facility after a fire.

10.7.1.7 TECHNICAL SAFETY REQUIREMENTS TIE-IN

Maintenance and operational procedures may be formalized in the nuclear facility's Technical Safety Requirements.

10.7.1.8 QUALITY ASSURANCE

All aspects of operations should be tied in to the facility Quality Assurance Program, which covers all of the areas required to produce quality work and to operate safely.

10.7.1.9 ASSESSMENTS

Periodic management and independent assessment are necessary to ensure that established requirements are adequate and are properly implemented.

10.8 GENERIC FIREFIGHTING PROCEDURES

The following recommendations apply to firefighting procedures and instructions. They provide a strategy that minimizes the likelihood of losing filtered, forced ventilation during a fire. These procedures were derived from extensive work at Rocky Flats and are included here because they are generically applicable to all DOE facilities where active fire protection measures are installed for filter plenum protection.

A special need for nuclear facilities with confinement ventilation systems is smoke venting. Obviously, smoke cannot be vented to the exterior, but there may be methods to use the confinement ventilation system to assist in removing some smoke from the fire area to enable more rapid intervention in manual suppression of the fire.

10.8.1 CONTROL VENTILATION CONFIGURATIONS, VOLUMES, AND FLOW RATES IN THE FIELD

An individual who is responsible for ventilation control (and successors or alternates in case of unavailability) must be established in the facility

emergency planning documentation. This individual must work in consultation with the Fire Department sector officer stationed in the control room or at the plenum to ensure a fire emergency will be successfully mitigated with minimal impact.

Pressure changes (DP) in the initial filter stages must be continuously monitored, even if the DP gauge readout is exceeded. Most gauges have a maximum capability of 4 to 6 in.wg, but a rapid drop from an off-scale high reading to a lower reading will confirm stage failure, as will a significant rise in DP for the next downstream stage. Attention should be focused on the first stage and the next downstream stage until a first stage failure is indicated. A rise in DP may be due to progressive filter plugging from fire particulates or wetting of the filters from deluge spray. Because the initial filter stages are usually (but not always) viewed as sacrificial, the DP may be allowed to rise to the maximum achievable by the fan. If there is only one stage of filtration, then this is not applicable.

For plena with four stages, the SOE should monitor the second- and third-stage DP at the first indication of a loss of first-stage filter integrity. The third and fourth stage DP should be monitored if the second stage fails.

Ventilation on the affected plenum should be throttled when DP across the final stage reaches 2 to 4 in.wg (4 in.wg is the current filter change-out criterion for normal operation).

Failure of initial stages and erosion of margin in the final stage is permitted if continued ventilation is necessary to support effective firefighting in the facility. If the Fire Department officer in charge judges that ventilation no longer provides a substantial advantage in controlling or containing the fire, and the Emergency Commander (generic term) validates that position, action should be taken to protect plenum margin (e.g., ventilation should be discontinued at 2 in.wg DP on the final stage). Throttling, if selected, should be performed in a manner that maintains the actual DP reading on scale within the 2- to 4-in wg readings at all times. In no case should ventilation be continued when 4 in.wg DP is reached across the final stage of filters.

At the first indication of an explosion, the first-stage DP should be monitored for a rapid or complete loss of DP as an indication of failure. The second-stage DP should be immediately monitored under such conditions and the filters should be visually inspected if possible. If the second-stage DP is less than 0.5 in.wg, or greater than 4 in.wg, or if there is visible damage to the second stage, ventilation on the affected plenum should be discontinued. Explosive conditions that could clearly impact multiple stages are judged to present too great a risk to any remaining stage to warrant any attempts to maintain ventilation.

Ventilation should be restored to an affected plenum only by the decision of the Emergency Commander or an approved Recovery Plan.

Restoration of ventilation should be considered likely to result in a forced convection release from the facility unless other recovery efforts have confirmed no airborne contamination is present in the facility.

10.8.2 ACTIVATION OF THE MANUAL DELUGE SYSTEM

The manual deluge system provides an important emergency capability should the first-stage filters be in danger of being consumed by fire. However, manual deluge system activation will likely result in loss of the first stage of filters either through plugging or media failure. Consideration may be given to intermittently flowing the deluge systems with the fans shut down when doing so for short time periods. Before actuating the manual deluge system, the following recommendations should be followed.

- Direct impingement of flame or burning embers on the first stage filters should be visually confirmed, if possible.
- The manual deluge system should be activated only when it is clearly required, because activation is likely to damage the filters, could cause plugging, and could stop ventilation. Early activation of manual deluge as a precautionary measure is considered imprudent. If the viewing ports are accessible, they should be used to facilitate confirmation of filter integrity (i.e., visible flaming or smoldering of filter media). Where viewing ports are inaccessible, the inner access doors to the airlocks should be used as alternative viewing ports.

- The manual deluge system should be activated only when the Fire Department officer in charge decides it is necessary, based on a determination from the available evidence that flame is present in the first stage of filters.
- The person in charge of ventilation control at the facility should be authorized to initiate the manual deluge system as necessary prior to Fire Department arrival. Possible filter plugging and shutdown of ventilation should be anticipated once manual deluge is activated.
- The initial filter stages should be monitored for evidence of plugging or blowout of the first-stage filter (DP changes) and for evidence of either particulate buildup/wetting (DP changes) or flame (visual) on the second and subsequent stages. If flame is confirmed on any downstream stage, all fans connected to the affected plenum should be secured immediately.

10.8.3 DELUGE SYSTEM FLOW TIMES

The following recommendations address when the deluge system flow should be terminated.

- The plenum deluge system flow should be discontinued upon visual verification by the Fire Department officer in charge that either:
  - (automatic system) there is no visible smoke in the plenum upstream of the spray nozzles and temperatures in the filter plena have dropped to safe levels, or
  - (manual system) the fire involving the first stage is extinguished and the spray duration is judged to have sufficiently cooled the filter media and frame.
- Only the Fire Department should be authorized to terminate the flow prior to meeting these criteria. Ventilation should only be restored to the affected plenum following a decision by Emergency Commander or in accordance with an approved Recovery Plan.
- If filter plugging is preventing effective ventilation, removal of the plugged media should restore ventilation. However, restoration of ventilation is likely to result in a forced convection release from the facility unless other recovery efforts have confirmed there is no airborne contamination in the facility. The removal of plugged filter media in a confinement ventilation system during a fire situation is fraught with hazards, of course, and should only be done in extreme circumstances.

10.8.4 MANUAL ACTIVATION OF THE AUTOMATIC DELUGE SYSTEM

Early activation of the automatic deluge system could increase the potential for the first filter stage to survive. For this reason, the automatic deluge system should be activated manually as soon as possible, rather than waiting for high-temperature actuation, wherever early activation provides an advantage. The decision to activate the system should be made by the Fire Department officer in charge based on initial assessment of the fire condition. Small fires that are under control and expected to be quickly extinguished would not challenge the HEPA filters sufficiently to warrant activation of the system. In addition, the limited available data indicate that early activation is not beneficial in reducing the potential for smoke-induced plugging for those plena equipped with fog jet nozzles for automatic deluge, and the procedures should not call for early activation of the automatic deluge system for those plena. Extensive preplanning should be conducted to define as much as possible the situations in which the automatic deluge system would be manually actuated before it automatically actuated.

The manual deluge system test does not normally significantly degrade the filtration capability of the first stage of HEPA filtration when demisters are installed in the filtration system. Therefore, it should be recognized that some credit for initial effectiveness of the first-stage filters is appropriate. There is considerable uncertainty about how much credit should be allowed.

10.8.5 BROADENING OF FIREFIGHTING STRATEGY/NEEDS

Inspections of the firefighting capabilities at Rocky Flats identified a number of areas where firefighting operations could be broadened. With that in mind, the following are considered good practices to enhance existing firefighting procedures.

- If there are processes within the confinement ventilation system that use flammable gases or liquids, explosion control should be considered in Fire Department operating procedures and prefire plans.
- Instructions and restrictions for use of hose lines on the final filter stage also should be considered.
- Emergency response fire drills should be conducted to practice the recommended actions and to provide further guidance on keeping exterior doors closed while fighting large and/or major fires.

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